DOCUMENT RESUME

ED 275 539 SE 047 522

| | |
|---|---|
| AUTHOR | Osis, Vicki J. |
| TITLE | Water, Water, Everywhere...A Guide to Marine Education in Oregon. Second Revised Edition. |
| INSTITUTION | Oregon State Univ., Corvallis. Sea Grant College Program. |
| PUB DATE | Jan 86 |
| NOTE | 27p. |
| AVAILABLE FROM | Oregon State Univ. Ext. Sea Grant Program, Hatfield Marine Science Center, Newport, OR ($2.50). |
| PUB TYPE | Guides - General (050) -- Reference Materials - Bibliographies (131) -- Reference Materials - Directories/Catalogs (132) |
| EDRS PRICE | MF01 Plus Postage. PC Not Available from EDRS. |
| DESCRIPTORS | Annotated Bibliographies; *Elementary School Science; Elementary Secondary Education; *Environmental Education; Experiential Learning; Field Trips; Interdisciplinary Approach; *Marine Education; *Resource Materials; Science Education; Science Materials; *Secondary School Science |
| IDENTIFIERS | *Oregon |

ABSTRACT

Designed to familiarize Oregon teachers with a variety of marine education materials, this guide offers suggestions and information for accessing marine education resources. Contents include: (1) project description; (2) marine education and goal-based instruction (explaining how to infuse marine education into existing courses); (3) marine education materials (providing listings of materials for grades K-6 and 7-12, reference books, Oregon State University (OSU) materials, California and Washington publications, newsletters and journals, organizations, audio-visual sources, Oregon river and stream materials, and OSU extension marine agents and specialists); (4) marine education field sites (providing names, addresses, and brief descriptions of sites); (5) safety considerations and field trip guidelines; and (6) checklist of resources (identifying potential resources by major topic areas). (ML)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

ED2755539

$2.50

# Water, Water, Everywhere...
## *A Guide to Marine Education in Oregon*

Oregon State University Extension Service

Second Revised Edition

EM 8303 / January 1986

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Vicki Osis

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE 047 532

# Water, Water, Everywhere...

## *A Guide to Marine Education in Oregon*

Second Revised Edition
by Vicki J. Osis
Extension Marine Education Specialist
and Associate Professor
Oregon State University

First Edition (1981)
by Bill Hastie
Marine Education Consultant
and Ray Thiess
Science Education Coordinator
Oregon Department of Education

**Oregon State University Extension Service**

**EM 8303 / January 1986**

## *Contents*


Study water? Not me! *3*
Water, water, everywhere... *4*
How did it come about? *4*
Who should use the materials? *4*
How do you use the materials? *4*
Where can you use the materials? *4*
Marine education and goal-based instruction *5*
How infusion works *5*
Science and marine education *5*
Art and marine education *6*
Social studies and marine education *6*
A framework *6*
Marine education materials *7*
K-6 materials *7*
7-12 materials *9*
The Marine Education Materials System *10*
Reference books *11*
Oregon State University materials *12*
Hatfield Marine Science Center *12*
Extension/Sea Grant Program *12*
Sea Grant College Program *13*
California and Washington publications *13*
Newsletters and journals *13*
Organizations *13*
A-V sources *14*
Oregon river and stream materials *14*
OSU Extension marine staff *14*
Marine education field sites *15*
Oregon State University,
Hatfield Marine Science Center *15*
Indoor programs *15*
Outdoor programs *15*
Slide sets *16*
Teacher checklist for visits *16*
Seatauqua program *16*
Other programs *16*
Other Oregon sites *16*
Astoria-Seaside area *16*
Tillamook area *16*
Depoe Bay area *17*
Newport area *17*
Yachats area *17*
Florence area *17*
Reedsport area *17*
Coos Bay area *18*
Bandon area *18*
Port Orford area *18*
Gold Beach area *18*
Brookings-Harbor area *18*
Portland area *18*
Coastal outdoor school sites *19*
At the water's edge *21*
Safety *21*
Conservation *22*
Learning *22*
After the trip *22*
Your "If All Else Fails" checklist *23*


## *Foreword*

This second edition of *Water, Water, Everywhere...* has come about through the efforts of Vicki Osis, Extension Marine Education Specialist at the OSU Hatfield Marine Science Center in Newport. But it would not have been possible without the continued encouragement and support of the original authors, Bill Hastie and Ray Thiess, and the encouragement of the many teachers who have used these marine-education materials.

We thank especially those whose cooperation has enabled us to expand the lists of materials contained in the first edition:

The staff of the Oregon Dunes National Recreation Area, Reedsport.

Patty Farthing, biology teacher, Corvallis High School, Corvallis.

Anja Robinson, research assistant, OSU Department of Fisheries and Wildlife, Hatfield Marine Science Center, Newport.

James Pease, Extension 4-H youth specialist, Iowa State University, Ames.

William Q. Wick
Director, Sea Grant College Program
Oregon State University

Because the ocean is at our doorstep,
children will, within their experience,
explore it to find what it is
and what it can do for them.

Paraphrased from a statement by Sharon Irvin,
Seward Elementary School, Seward, Alaska

# Study Water? Not Me!

But it's everywhere! Inescapably!

Over 70 percent of our planet's surface, the sea. Over 97 percent of our planet's water, the sea. What's left, the nearly 30 and 3, depends on the sea.

We depend on the sea (and all water) without knowing it. For food. For drink. For jobs. For commerce. For defense. For fun. For ...?

At Halfway, Oregon, they depend on it.

But if we depend on it so, why don't more of us study more about it? Why does the sea remain a mystery?

Could one reason be: The sea means science? Science means an eccentric teacher (always in a white lab coat)? This means students may take some other course?

What if...?

What if science teachers turned that image around? Taught science a different way? Not as a discipline with subject matter all its own? But merely as methodology? As a systematic way of looking at nature and the physical world?

What if they took the next step? Asked others for help? Others who think they, too, have contributions to make? And gave help? To others who likewise really have no subject matter all their own? Teachers of math? language arts? music? art? history?

Could bold science teachers thus begin to transcend traditional subject-matter bounds? Cross disciplines? Explore connections between science and society? Help and receive help from other teachers?

What might the strategy be?

Even if marine education is not required in most schools, couldn't it add a valuable dimension to established curriculum? If teachers use the sea as one of many subject matters[1] and as the method to systematize learning about it, could they ask for and give complementary trades? Could they get administrative support? Could students learn more about nature and the physical world and other subjects?

Could asking for help (and giving it in turn) bring together traditionally holed-up interests? Could the sea as subject matter and science as a way to look at it, awaken teachers who'd maybe never thought much about water at all? Who had, as most of us, taken it for granted?

But who, if the right trade could be worked out, could find reason and excitement to study the sea? other water? and why is all water important? Could a few teachers with imagination and appetite for something better get together and, as a smile, infect others?

Could, for example, art teacher and science teacher help each other? Art teacher contributing, say, visual interpretations of patterns and symmetry in water life; science teacher contributing technical explanations to make interpretations come alive? Could they together explore a pristine sea? mountain stream? alpine lake? rain puddle?

Could music teacher, history teacher, and science teacher all help each other by trading talents to show that "15 miles on the Erie Canal" is more than a lyric? that perhaps nature has a way of influencing political, social, economic, religious, and scientific dilemmas taken up in song for relief? that life on the river or the sea is hard?

Could history teacher, geography teacher, and science teacher explain movements and countermovements as reaction-action-reaction chains? Why, for example, did early American colonists bring rum kegs? Why did later settlers press on beyond some lands? What has water got to do with either?

Could language arts teacher and science teacher help each other? Explore themes in literature (e.g., *Moby Dick, Huckleberry Finn*)? Help students read science textbooks more effectively?

And on and on... home economics teacher and science teacher having creative fun with foods from the seas... agribusiness teacher and science teacher helping each other "farm the seas" (and how could really good lessons avoid economics, politics, history, language arts?)... elementary teachers working together to organize a "sea week"... industrial arts teacher and science teacher exploring technology...?

In short, could the same imagination applied to space be applied to water?

Who'll take it from here...? Will you?

(This section is adapted from *Developing Model Marine Educational Activities,* Oregon Department of Education, Salem, June 1979).

[1]Any other parts of nature and the physical world could be subject matters as well, just as fear or love or hate might be subject matters for the dramatist or novelist.

# Water, Water, Everywhere...

Before you sail into marine education, perhaps you would like to know something about the project that made this publication possible.

## *How Did It Come About?*

This project was made possible through a grant to the Oregon Department of Education from the Oregon State University Sea Grant College Program. These and subsequent materials are the results of an extensive nationwide search for marine education activities. The materials were then altered to fit a common format to be useful in Oregon. Finally, they were field-tested in Oregon classrooms.

The purpose of this project is to get quality marine education materials into the hands of Oregon teachers and introduce teachers to the wide variety of marine education materials available.

## *Who Should Use the Materials?*

Anyone! Everyone! Not just science teachers.

## *How Do You Use the Materials?*

This publication is designed to illustrate how the activities can be used. It includes information that will be helpful in accessing marine education resources in Oregon.

The activities (available separately from the OSU Extension/Sea Grant Program, Hatfield Marine Science Center, Newport 97365) are organized by a conceptual framework for marine education. The framework reveals the universal nature of the world of water, salt and fresh.

Examples of ways to *infuse* water-related activities into other subject matters are included. Infusion could occur by using the activities to:

1. supplement an established marine education unit or course;
2. replace activities in present units or courses that do not deal with the water world; or
3. form the basis of a marine education unit or course.

The activities are divided into K-6 and 7-12 groupings. Don't let this prevent your adapting a K-6 activity for your 7-12 classroom, or vice versa.

## *Where Can You Use the Materials?*

In Seaside or Jordan Valley. In Portland or Ione. In Sutherlin or Sisters. Anywhere!

Remember, activities are only places to begin. Creative and enthusiastic teachers need to breathe life into them.

Now, go ahead... try one!

# Marine Education and Goal-Based Instruction

Goals give purpose and direction when you plan activities, and they provide a common language for discussing the merits of activities as you carry them out. As a reference for planning, districts use state goals, district goals, program goals, and course goals.

State goals describe what the Oregon Department of Education thinks a student ought to learn in public school. District goals describe what the local community and its schools think a student ought to learn in school locally, and how such learning relates to state goals.

Program goals describe what local curriculum planners and teachers think a student ought to learn in a program (such as social studies, math, science) and how such learning relates to district goals. Course goals describe what teachers think a student ought to learn in their particular course or unit and how such learning relates to program goals.

Here's how marine education can help you accomplish these goals. Marine education is that part of environmental education that deals with water in all its forms. The term *marine education* is intended to encompass both saltwater and freshwater education.

Harold L. Goodwin and James G. Schaadt, in *The Need for Marine Aquatic Education* (Newark, DE: University of Delaware Sea Grant College Program, 1978), defined salt-water and freshwater education as "...that part of the total educational process which enables people to develop a sensitivity to and a general understanding of the role of the seas and fresh water in human affairs and the impact of society on the marine and aquatic environments."

Marine education transcends traditional subject matters; in fact, it is a thread running through all these subject matters. Marine education is, therefore, appropriate in every program—science to music to agriculture.

Marine education can be used as an exciting means to reach those goals we set for our students. Using marine education activities in this way is called *infusion*. Infusion does *not* require that you add new courses or goals to present programs.

*A special note:* The sections that follow refer to several publications of the Oregon Department of Education in Salem. Single copies of each title are available at no charge from the department.

## *How Infusion Works*

Marine education may be infused into almost any course. A music class sings sea chanties. Students learn to prepare and cook seafoods. An auto mechanics student works on a marine diesel engine. Students read *Moby Dick*. Math students use navigation to learn time, rate, and distance relationships. A physical education class learns water safety techniques. Students investigate seafood nutrition.

A class investigates the economic impact of a port or river, the part the Columbia River played in the development of Oregon, or the history of ships and shipbuilding. These are only a few of many ways in which the excitement of the water world can be drawn upon to accomplish your goals.

The next three sections use examples to show how infusion can occur in three subject areas.

## *Science and Marine Education*

Infusing marine education into your science course will mean replacing *a part* of what you do now. But you can replace a part easily. Just be sure the marine education activity you plan to use accomplishes the same goals as the one you replace.

For example, before you replace an activity about sparrows with one about sea stars, ask yourself: Will my students learn the same things if I use sea stars instead of sparrows?

The *Framework for Science Programs* (Oregon Department of Education, Salem, 1979) suggests seven goals, with several dimensions each, for Oregon's science education programs. Here are three examples of how infusion might happen in science, using the goals and dimensions with activities from this project.

**Example: Program Goal I.** *Students will know scientific concepts and related theories, laws, assumptions, and facts.*

To support this goal, a course goal might state (using the dimension "cycle" from the *Framework for Science Programs):*

The student will know that organisms go through cycles, patterns in which events or conditions seem to be repeated at regular intervals.

You may be using the life cycle of, say, a fern or fruit fly to illustrate a cycle and accomplish this goal. You could accomplish the same goal by using the water-related activity "The Comings and Goings of Coho" from this project.

Remember, you're replacing one activity, not your entire curriculum.

**Example: Program Goal II.** *Students will be able to apply scientific problem-solving and inquiry processes.*

To support this goal, a course goal might state (using the dimension "classifying" from the *Framework for Science Programs):*

The students will be able to classify organisms using a dichotomous key.

You may be using leaves or nuts or bolts to help your students learn how to use keys. Why not use "Meet Your Neighbors: Experience Using a Dichotomous Key" from this project to accomplish the same goal?

**Example.** In some cases you can simply use water-related examples in the activities you now use. This was done in the activity "Marine Food Chain Game." The activity was originally written by *OBIS* (Lawrence Hall of Science, *Outdoor Biology Instructional Strategies,* University of California, Berkeley, 1975) using popcorn plants, grasshoppers, frogs, and hawks to illustrate a food chain. It was rewritten using phytoplankton, copepods, small fish, and large fish.

## *Art and Marine Education*

Infusing water education into your art course can be as easy as using the sea or a stream as inspiration for activities you do now. Or using marine materials (shells, sand, driftwood, etc.) for projects already planned. Neither would require any change in your course goals. And there certainly is no shortage of inspiration or materials in the water world!

*A Pattern for Art: K-12* (Oregon Department of Education, Salem, 1981) lists six suggested program goals for art students, any one of which may be supported by marine education.

**Example: Program Goal II.** *Students will be able to use tools, materials, and processes to create works of art.*

To support this goal, a course goal might state:

Students will be able to select tools, materials, and processes appropriate to their purpose.

Activities from this project which could be used with this goal include "Flotsam, Jetsam and Wrack Art" and "Gyotaku: Japanese Fish Printing."

## *Social Studies and Marine Education*

Infusing marine education into social studies courses, as in science, means replacing *part* of what you do now. This can be done easily without changing your program or course goals.

*Social Studies in Oregon Schools* (Oregon Department of Education, Salem, 1981) lists seven suggested program goals supported by various thinking, map and globe, reading, values awareness, citizenship, mathematics, and communication skills. Here's an example of how infusion might take place, using one of these goals and an activity from this project.

**Example: Program Goal.** *Students will be able to participate in societal activities as individuals, family members, and as members of other groups.*

To support this goal, a course goal might state:

Students will be able to actively participate in one project related to planned management of a local natural resource.

"Fish, Fisheries and You" provides students with an opportunity to reach that course goal. In addition, skills such as thinking (observing, classifying, generalizing, analyzing, synthesizing, predicting, identifying problems, and proposing solutions), reading (comprehending and interpreting), and citizenship are addressed.

## *A Framework*

The following framework outlines *one way* of looking at marine education. It shows why learning about water should be a part of education, defining marine education from a dependence point of view.

The framework provides a way or organizing marine education lessons and activities. The activities in this publication are organized using this framework.

*Student:* What are we going to learn about today?
*Teacher:* Water.
*Student:* Why should we learn about water?
*Teacher:* People depend on water...
*Student:* For what?
*Teacher:* First, for life:

- Water—the incomparable compound—supports life.
- Water environments support life.
- Water shapes our planet—and, therefore, how and where we live on it.

Second, for livelihood:

- People manage and harvest food, energy, minerals, and other resources from water environments.
- People manage and use water for residential and industrial needs.
- People manage and use water for trade and transportation.

Third, for inspiration:

- Water provides places for thought and fun.
- Water inspires creative works.

What about you? If you already use marine education activities, could the framework help you expand your programs?

You don't use marine education activities? Could the framework help you select appropriate activities for your classroom?

# Marine Education Materials

## *K-6 Materials*

These K-6 projects are *some* of the marine education materials on file at the Hatfield Marine Science Center, Newport, OR 97365. The projects are available to anyone wishing to use them. Schools can arrange curriculum workshops that use the materials by contacting the Marine Education Specialist at the Center, (503) 867-3011.

Arbus, Bill, and Karen Gartland, *Marine Biology Activity Cards.* Available from: OSU Extension/Sea Grant Program, Hatfield Marine Science Center, Newport, OR 97365. Packet of pocket-sized cards designed to introduce teachers or group leaders to information and activities to use on a tidepool field trip.

Bagnall, Norma, *Children's Literature: Passage to the Sea.* 1980, 50 pp. Available from: Sea Grant College Program, Texas A & M University, College Station, TX 77843. A marine-awareness learning package of books that use the sea as their themes. Each book mentioned has descriptions of classroom learning centers to reinforce the literature being read. Also available: *Sea Sources* by Norma Bagnall, a bibliographic resource list (745 titles) of children's literature of the sea.

Butzow, John W., *Northern New England Marine Education Project.* Available from: Marine Advisory Program, 30 Coburn Hall, University of Maine at Orono, Orono, ME 04469. A series of multidisciplinary, K-12 units that deal with whales, clams, marine art, aquaria, beavers, lobsters, coastal Indians, mussels, ships, lighthouses, wetlands, seafoods, aquaculture, and navigation.

Callaghan, Sara S., *Teacher's Activity to Coastal Awareness.* 1978, 85 pp. Available from: Rhode Island Coastal Resources Management Council, 83 Park St., Providence, RI 02903. Activities, ideas, and resources for marine education in the elementary classroom. Also available: *Down Here The Water Is: A Coastal Awareness Activity Book* (23 pp.) by Sara S. Callaghan. Can be used with *Teacher's Activity* (above); a coloring book emphasizing the importance and use of our coastal resources.

Coastal and Oceanic Awareness Studies, *Project Coast.* Available from: Project Coast, College of Education, University of Delaware, Newark, DE 19711. Large collection of multidisciplinary activities, all individually packaged. Includes slides, reference material, posters, tests, and a conceptual framework.

Coon, Herbert L., and Charles L. Price, *Water Related Teaching Activities.* 149 pp. Available from: Science, Mathematics & Environmental Education (SMEAC), Information Referral Center, 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212. Booklet of K-12 water-related teaching activities and resources.

Cowan, Elizabeth, and Karen Davis, *Fairy Tales of the Sea.* 1981. Available from: Sea Grant College Program, Texas A & M University, College Station, TX 77843. A collection of international fairy tales of the sea suitable for young readers. Also available: *Fairy Tales of the Sea Teacher's Guide,* by Donna Wiseman, a guide to using *Fairy Tales of the Sea* in grades 4-9 language arts units. *Mini-Learning Centers Set I: Language Arts,* a collection of student-centered language arts activities for grades 4-6.

Curriculum Research and Development Group, *Hawaii Nature Study Program: Reef and Shore.* Available from: Curriculum Research & Development Group, 1776 University Ave., Honolulu, HI 96822. An extensive collection of interdisciplinary classroom and field activities, with information on using aquaria and other equipment.

Dyckman, Claire, and Richard Duncan, *Clean Water Streams and Fish: A Holistic View of Watersheds.* 1983. Available from: OSU Hatfield Marine Science Center, Newport, OR 97365. Activities and workshops that deal with Pacific Northwest salmon. Looks not only at the fish but at the system that supports the populations of fish—Northwest streams and watersheds.

Elk, Catherine, *A Teacher's Guide to the Whales of the Gulf of Maine.* 1984, 69 pp. Available from: Sea Grant Communications Office, 30 Coburn Hall, University of Maine, Orono, ME 04469. Background information, classroom activities, teacher resources, fact sheets, checklists, etc.

Energy and Man's Environment Inc., *Water for Energy*. 89 pp. Available from: Program Coordinator, Water and Man, Inc., 220 S 2nd East, Suite 330, Salt Lake City, UT 84111. Activities intended to spark discussion, research, and understanding of important concepts related to water and energy.

Environmental Resource Council, *Adventures on the Beach: Teacher's Guide for Grades K-12*. 104 pp. Available from: Publications Sales Office, New York City Public Schools, 110 Livingston St., Brooklyn, NY 11201. Activities and ideas for classroom and field trips. Includes techniques for use of sampling equipment.

Frost, Marsha, and Michael Spranger, *The Columbia River: Its Future and You*. Available from: OSU Hatfield Marine Science Center, Newport, OR 97365. Geared for grades 5-8. These materials address all uses of the Columbia River and look at some of the conflicts rising from so many users of the same resource.

Highline Public Schools, *Project Ecology* (Environmental Career-Oriented Learning). Available from: Project Ecology, Willis F. Guise, Director, Highline Public Schools #401, 15675 Ambaum Blvd. SW, Seattle, WA 98166. Phone (206) 433-2453. Includes "Water," a 70-pp unit designed to develop an awareness of the importance of water in our lives, what water can do, and our responsibility to help protect and conserve our water supply.

Kolb, James A., *Marine Science Project: For Sea*. Port Townsend, WA: Educational Service District 114. Available from the Project: 17771 Fjord Dr. NE, Poulsbo, WA 98370. Three curriculum guides contain conceptual frameworks, student texts, activity sheets, teacher materials, bibliography, answer keys, and aquaria guides:

*Marine Science Activities: Grade 2* (545 pp.). Provides students with an introduction to the ocean and its plants and animals. Through activities and readings, students survey the ocean surface, ocean floor, tides, fish, invertebrates, and marine plants. Concludes by looking at the relationships that exist between plants, animals, and people in the sea.

*Marine Science Career Awareness: Grade 4* (176 pp.). Focuses on career opportunities in the marine realm. Commerce and the intertidal beaches, crabbing, clam and oyster harvesting, shrimping, fishing, aquaculture, and mariculture provide topics for discussion. The biology of the harvested animals, how the animals survive in the seas, and career awareness information are included.

*Marine Science Activities: The Marine Environment: Grade 6* (223 pp.). Presents activities and readings dealing with both the physical and biological environments of the ocean. The award-winning children's book *Pagoo* provides a thread that unifies topics from the role of plankton in the food chain to the differences between fresh- and saltwater.

Lawrence Hall of Science, University of California (Berkeley), *Outdoor Biology Instructional Strategies (OBIS)* (Nashua, NY: Delta Education Inc., 1981). Available from: Delta Education, Inc., Box 107, Tyngsboro, MA 10879. Modules of activities suitable for outdoor or classroom use. Includes modules dealing with aquatic and marine studies.

Machlis, Sally, and Nancy Field, *Discovering Salmon: A Learning and Activity Book*. 1985, 35 pp. Available from: Dog Eared Publications, P.O. Box 814, Corvallis, OR 97339. A series of activities to teach children about salmon.

Maraniss, Linda, *The Ocean: Consider the Connections*. 1985, 98 pp. Available from: Center for Environmental Education, 624 9th St. NW, Washington, DC 20001. Fifty activities to introduce students to the marine environment, including weather, currents, tides, marine biology, adaptation, ecosystems, people and the sea.

Mathematics and Science Center, *Man and the Sea*. 1970, 87 pp. Available from the Center, 2200 Mt. Rd., Glen Allen, VA 23060. A collection of grade 6 units and activities designed to help teachers develop an instructional unit in marine science.

Michelson, Bell, *Alaska Sea Week Curriculum Series*. 1985. Available from: University of Alaska Sea Grant, Fairbanks, AK. The materials include 7 volumes, each dealing with a different topic. The first is geared for kindergarten up to grade 6. Although designed for use in their Sea Week Program, the materials include much more information than would be included in a 1-week period.

Murphy, Richard, *Wet and Wild*. Available from: Evaluation, Dissemination and Assessment Center, California State University, 5151 State University Dr., Los Angeles, CA 90032. Six units covering the physical ocean, ocean management, research, biology, economics, and ecology. Includes materials in Spanish for bilingual classes.

Newton, David and Irwin L. Slesnick, *Hanging Onto The Wetlands*. 1985. Available from: Western Washington University, Bellingham, WA. Looks at swamps, marshes, and bogs in the U.S. Activities for field and classroom. Illustrations of plants and animals that live in the wetlands. Three levels—elementary, middle school, and high school.

Ohio Sea Grant, *Oceanic Education Activities for Great Lakes Schools (OEAGLS)*. 1979. Available from: Ohio Sea Grant Education Office, 283 Arps Hall, 1945 N High St., Columbus, OH 43210. Individually packaged, interdisciplinary activities for grades 5-9.

Osis, Vicki, Peter Bellamy, Jan Komar, and Marsha Frost, *Shipping and Trade on the Columbia River*. 1986. Available from: Extension/Sea Grant Program, OSU Hatfield Marine Science Center, Newport, OR 97365. A curricula guide for teachers on trade and the interdependence of Pacific countries.

Pacific Science Center, *Ocean Related Curriculum Activities (ORCA)*. Available from: Pacific Science Center, 200 2nd Ave. N, Seattle, WA.

Rasmussen, Frederick A., *Coastal Awareness Resource Guide for Teachers in Elementary Science*. 1978, 84 pp. Available from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Activities, resources, and information on wind, waves, currents, tides, rocky shores, beaches, estuaries, and marshes.

Sinclair, Glenn and Associates, *Salmonids in the Classroom*. Available from: B.C. Teachers Federation, Lesson Aides Service, 105-2235 Burrard St., Vancouver, BC, Canada V6J 3H9. An extensive, interdisciplinary project. Includes activity sheets, lessons, optional activities, references in 5 loose-leaf volumes.

South Slough Estuarine Sanctuary, *The Estuary Study Program*. Available from the Center, PO Box 5417, Charleston, OR 97420. Three curriculum levels, grades 4-8.

Spence, L., and V. B. Cox, *Coastal Capers: An Education Primer*. 1974, 76 pp. Available from: North Carolina State University, 105 1911 Bldg., Raleigh, NC 27650. Activities to introduce the marine environment, each designed to motivate students to learn basic skills in science, math, language arts, social studies, or art.

Western Education Development Group, *The Beach Book*. 1978, 48 pp. Available from: Western Education Development Group, University of B.C., Vancouver, BC, Canada V6T 1W5. Activities for beach field trips. Also available: *The Snowbook, The Pond Book, The Creek Book, Grounds for Erosion, The Lake Book*.

## *7-12 Materials*

These 7-12 projects are *some* of the marine education materials on file at the OSU Hatfield Marine Science Center. The projects are available to anyone wishing to use them. Schools can arrange curriculum workshops that use the materials by contacting the Marine Education Specialist at (503) 867-3011.

Arbus, Bill, and Karen Gartland, *Marine Biology Activity Cards.* Available from: Coos County ESD, 1350 Teakwood, Coos Bay, OR 97420. Also available from: Extension/Sea Grant Program, OSU Hatfield Marine Science Center, Newport, OR 97365. Packet of pocket-sized cards designed to introduce teachers or group leaders to information and activities to use on a tidepool field trip.

Bureau of Curriculum Development, *Marine Biology for High School.* Available from: Publications Sales Office, New York City Public Schools, 110 Livingston St., Brooklyn, NY 11201. Course of study in three volumes; designed to take a year to complete: vol. I, *Instructional materials covering the Protista through Chordata* (105 pp.); vol. II, *Field and laboratory manual of lab and onsite activities* (169 pp.); vol. III, *Books and periodicals for an oceanography library* (31 pp.). Also available: *Interdisciplinary Oceanography for High School,* in three volumes: vol. I, *Marine Science, Marine Biology, Mathematics* (152 pp.); vol. II, *English, Foreign Languages—French, Spanish* (346 pp.); vol. III, *Fine Arts, Social Studies* (478 pp.).

Butzow, John W., *Northern New England Marine Education Project.* 1979. Available from: Marine Advisory Program, 30 Coburn Hall, University of Maine at Orono, Orono, ME 04469. A series of multidisciplinary K-12 units that deal with whales, clams, marine art, aquaria, beavers, lobsters, coastal Indians, mussels, ships, lighthouses, wetlands, seaweeds, aquaculture, and navigation.

Coastal and Oceanic Awareness Studies, *Project Coast.* 1979. Available from: Project Coast, College of Education, University of Delaware, Newark, DE 19711. Large collection of multidisciplinary activities, all individually packaged. Includes slides, reference material, posters, tests, and a conceptual framework.

Conrath, Gernald, and Michael Spranger, *The Columbia River: Its Future and You.* Available from: OSU Hatfield Marine Science Center, Newport, OR 97365. Geared for grades 9-12, these materials address all uses of the Columbia River and look at some of the conflicts arising from so many users of the same resource.

Coon, Herbert L., and Charles L. Price, *Water-Related Teaching Activities.* 1977, 149 pp. Science, Mathematics & Environmental Education (SMEAC). Available from: Information Referral Center, 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212. K-12 water-related teaching activities and resources.

Curriculum Research and Development Group, *Coastal Problems and Resource Management.* 1979, 231 pp. Available from: Marine Social Studies Project, 1776 University Ave., University of Hawaii, Honolulu, HI 96822. A secondary, 1-semester course focusing on the coastal region of the U.S. and the political, economic, and ecological factors involved in developing coastal resources. Includes teacher's guide, student worksheets, and student readings. Also available: *Ostrich Bay,* a simulation game.

Curriculum Research and Development Group, *High School Marine Science Studies.* 1980. Available from the Group, 1776 University Ave., Honolulu, HI 96822. Designed as a 1-year secondary marine science curriculum. Includes teacher's guide, student book, and student workbook. Disseminated through teacher workshops.

Dyckman, Claire, and Richard Duncan, *Clean Water Streams and Fish: A Holistic View of Watersheds.* 1983. Available from: OSU Hatfield Marine Science Center, Newport, OR 97365. Activities and workshops that deal with Pacific Northwest salmon. Looks not only at the fish but also at the system that supports the populations of fish—Northwest streams and watersheds.

Energy and Man's Environment, Inc., *Water for Energy.* 1979, 89 pp. Available from: Program Coordinator, Water and Man, Inc., 220 S 2nd East, Suite 330, Salt Lake City, UT 84111. Activities intended to spark discussion, research, and understanding of important concepts related to water and energy.

Environmental Resource Council, *Adventures on the Beach: Teacher's Guide for Grades K-12.* 1972, 104 pp. Available from: Publications Sales office, New York City Public Schools, 110 Livingston St., Brooklyn, NY 11201. Activities and ideas for classrooms and field trips. Includes techniques for using sampling equipment.

Highline Public Schools, *Project Ecology (Environmental Career-Oriented Learning).* 1979. Available from: Project Ecology, Willis F. Guise, Director, Highline Public Schools #401, 15675 Ambaum Blvd. SW, Seattle, WA 98166. Phone (206) 433-2453. Includes: *The Drip Impact* (102 pp.), a complete 3-week unit emphasizing water, water analysis, and possible methods of watershed management; and *Water* (74 pp.), a complete 3-week unit dealing with the characteristics of water, the hydrologic cycle, sewage treatment, and pollution.

Hodder, Jan, and Michael Greybill, *The Estuary: An Ecosystem and a Resource.* Available from: South Slough Estuarine Sanctuary, P.O. Box 5417, Charleston, OR 97420. Includes teacher's guide, field trip guide, and laboratory manual for use with secondary level students.

Hunt, John D., *Marine Organisms In Science Teaching.* 1980, 192 pp. Available from: Marine Information Service, Sea Grant College Program, Texas A & M University, College Station, TX 77843. Action-oriented experiences with handy organisms that can be maintained for periods of time at little expense and effort in any classroom.

Irby, Bobby, Malcolm McEwen, Sheila Brown, and Elizabeth Meek, *Man and the Gulf of Mexico: Marine and Estuarine Ecology.* 1984. Available from: Mississippi-Alabama Sea Grant Consortium, Gulf Coast Research Lab, Caylor Bldg., Ocean Springs, MS 39564. Text-workbook explores and introduces marine and estuarine ecology. Other volumes in the series: *Marine Habitats, Diversity of Marine Plants,* and *Diversity of Marine Animals.*

*Kolb, James A., Marine Science Project: For Sea.* Available from the Project: 17771 Fjord Dr. NE, Poulsbo, WA 98370. Two curriculum guides contain conceptual frameworks, student texts and activity sheets, teacher materials, bibliography, answer keys, and aquaria guides.

*Marine Biology and Oceanography: Grades 9-12.* Provides an in-depth look at the physical and biological factors that influence life in the sea. Part I (367 pp.) looks at the study of the oceans historically as an introduction to activities and readings treating the ocean floor, tides, waves, currents, pressure, and the water solution. Part II (1,039 pp.) focuses on the nature of oceanic life from the microscopic marine bacteria to the macroscopic great whales. The unit concludes with a study of current issues in ocean use and management.

*Marine Biology and Oceanography: Grades 7-8.* Designed to contribute the knowledge necessary to make sound decisions concerning the marine environment. The California gray whale provides a continuous thread throughout the activities, which deal with ocean basins, physical oceanography, adaptation and diversity of organisms, marine ecology, whaling, boating, and offshore mining and oil (696 pp.).

Korporaal, Arie R., and Steven McDonough, *Student Manual for the Los Angeles County Marine Science Floating Laboratory*. 1979, 40 pp. Available from: Office of the Los Angeles County Superintendent of Schools, Division of Curriculum and Instructional Services, Marine Science, 9300 E Imperial Highway, Downey, CA 90242. Intended to familiarize students who will spend a day aboard the Marine Science Floating Lab. Includes information on equipment and organisms.

Lawrence Hall of Science, University of California (Berkeley), *Outdoor Biology Instructional Strategies (OBIS)*. 1980. Available from: Delta Education, Inc., Box 107, Tyngsboro, MA 10979. Modules of activities suitable for outdoor or classroom use. Includes modules dealing with aquatic and marine studies.

Lien, Violetta F., *Investigating the Marine Environment and its Resources*. 1979, 575 pp. Available from: Sea Grant College Program, Texas A & M University, College Station, TX 77843. Teaching unit focusing on the future of our environment. Relates our use of marine and terrestrial resources to regional and global responses. Interdisciplinary, 2 volumes; includes filmstrips, tapes, and other teaching aids.

Mathematics and Science Center, *Exploring Inner Space: A Guide to Teaching Marine Science*. 56 pp. Available from: Mathematics & Science Center, 2200 Mt. Rd., Glen Allen, VA 23060. A collection of units and activities in physical oceanography, with film list.

Mauldin, Lundie, and Dirk Frankenburg, *North Carolina Marine Education Manual*. 1978. Available from: North Carolina State University, 105 1911 Bldg., Raleigh, NC 27650. Phone (919) 737-2454. Five volumes designed to provide supplemental material to existing curricula: vol. I, *Coastal Geology: Geology & Geography* (108 pp.); vol. II, *Seawater: Tides, Waves, Seawater* (76 pp.); vol. III, *Coastal Ecology: Marine Organisms and Their Adaptations, Habitats and Interrelationships* (100 pp.); vol. IV, *Coastal Beginnings: Past Cultures of Coastal People* (175 pp.); vol. V, *Appendices: Aquariums, Games, Periodicals, Films* (36 pp.).

National Coordinating Center for Curriculum Development, *Whales*. 1980, 33 pp. Available from Ginn Custom Publishing, 191 Spring St., Lexington, MA 02173. A module that uses whales as the theme to explore the relationship between the content of a piece of writing and how it is written. Also available: *Offshore Limits* (26 pp.), a mathematics module in geometry, designed to teach students some of the geometric techniques used to establish offshore boundaries and measure offshore territories.

Nixon, Pendleton H., *People and the Sea*. 1978. Available from: University of Rhode Island, Marine Publications Unit, Narragansett Bay Campus, Narragansett, RI 02882. Three units; each teaches language arts skills through the theme of "People and the Sea"; based on well-written literature about the sea appropriate to the students' reading level: *Coastal Life, A Unit for 7th Grade English Classes* (55 pp.), *Adventure at Sea, A Unit for 8th Grade English Classes* (55 pp.), and *The Relationship Between People and the Sea, A Unit for 9th Grade English Classes* (49 pp.).

Ohio Sea Grant, *Oceanic Education Activities for Great Lakes Schools (OEAGLS)*, 1979. Available from: Ohio Sea Grant Education Office, 283 Arps Hall, 1945 N High St., Columbus, OH 43210. Individually packaged, interdisciplinary activities for grades 5-9. Pacific Science Center, *Ocean Related Curriculum Activities (ORCA)*. Available from: Extension/Sea Grant Program, OSU Hatfield Marine Science Center Bookstore, Newport, OR 97365. Series of junior high units; includes activities and information on beaches, energy and the sea, literature and the sea, tides, and oceanographic tools.

Rasmussen, Frederick A., *Coastal Awareness Resource Guide for Teachers in Senior High Science*. 1978, 72 pp. Available from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Activities, resources, and information on wind, waves, currents, tides, rocky shores, beaches, estuaries, and marshes. Also available: *Coastal Awareness Resource Guide for Teachers in Junior High Science* (92 pp.).

Sinclair, Glenn, and Associates, *Salmonids in the Classroom*. Available from B.C. Teachers Federation, Lesson Aides Service, 105-2235 Burrard St., Vancouver, BC, Canada V6J 3H9. An extensive interdisciplinary project; includes activity sheets, lessons, optional activities, references.

South Slough Estuarine Sanctuary, *The Estuary Study Program*. Available from the Center, PO Box 5417, Charleston, OR 97420. Three curriculum levels, grades 4-8.

Texas A & M University, *The Day on the Bay*. 1978, 33 pp. Available from Sea Grant College Program, Texas A & M University, College Station, TX 77843. A pretrip laboratory manual designed to familiarize students with cruise procedures and equipment. Includes explanations of use of cover, plankton nets, Secchi disc, otter trawl, etc., and techniques to measure salinity, D.O. and BO.O.D.

Webb, Anita H., Anita E. Kimmich, and Sandra E. Howlett, *Seafood Products: Food Service Program Guide*. 1979, 93 pp. Available from Sea Grant Program, Extension Division, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. Developed for occupational home economics food service programs. Contains activities useful in all home economics programs. Also available: *101 Bulletin Board Ideas for Seafood Education* (105 pp.), by Anita H. Webb.

Weiss, Howard M., and Michael W. Dorsey, *Investigating the Marine Environment: A Source Book*. 1979. Available from: Project Oceanography, Avery Point, Groton, CT 06340. A three-volume set of selected field studies and classroom activities for students and teachers using the project: vol. I, *Field Studies* (318 pp); vol. II, *Lab and classroom activities* (301 pp); vol. III, *Teacher's manual* (349 pp).

Western Education Development Group, *The Estuary Book*. Available from Western Education Development Group, University of B.C., Vancouver, BC, Canada V6T 1W5. Teacher's guide to the investigation of estuaries. Activities are designed to fit into environmental studies, social studies, biology, physics, and chemistry at the secondary level. Also available: *The Lake Book*, teacher's guide to science-oriented studies and student activities in the lake environment.

## *The Marine Education Materials System*

How do you go about finding other useful marine education materials? Here's one way.

The Virginia Institute of Marine Science (VIMS), with assistance from the National Sea Grant Program, has devised the national Marine Education Materials System (MEMS) for the collection, storage, retrieval, and dissemination of marine education materials.

Numerous marine education materials had existed before, but they were not readily available until MEMS was developed. No coordinated national search had ever been made to provide easy access to marine-related materials. Through the use of this system, an educator in any educational discipline and from any part of the country can access marine education materials for infusion into his/her subject area.

All materials in MEMS are first reproduced onto microfiche, a type of microfilm on which up to 60 pages of printed information are filmed on a 4 × 6 inch frame. This technique allows for compact storage and economical distribution. Permission is then obtained from authors and publishers of the documents to distribute the document on microfiche through the Marine Education Materials System.

An accession number is assigned to each entry, which is classified by date, author, title, and source of publication. Descriptors are assigned, such as "wave," "sand," "salinity," or "fish," so that articles can be retrieved by subject. The publication is also classified as to *type* of educational material (lesson plan, field guide, curriculum, etc.) as well as by grade level. All this information is then entered into the computerized retrieval system.

The *Marine Education Materials System Guidebook* is available from MEMS, VIMS/SEA GRANT, Marine Education Center, Gloucester Point, VA 23062, phone (804) 642-2111, ext. 111. This guidebook contains an explanation of MEMS and how to use it, and an index of descriptors. Using this index, it's possible to search for the specific materials you desire.

The Educational Resources Information Center (ERIC) also houses a collection of the materials in MEMS and lends extensive and valuable assistance, both by providing printouts of pertinent ERIC materials and searching MEMS listings for those articles suitable for inclusion in ERIC.

## *Reference Books*


Anikouchine, William A., and Richard W. Sternberg, *The World Ocean: An Introduction to Oceanography* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1973). A study of chemical, physical, and biological oceanography.

Bascom, Willard, *Waves and Beaches: The Dynamics of the Ocean* (Garden City, NY: Doubleday and Co., Inc., 1964). Describes waves, beaches, and their interactions.

Beckham, Steven Dow, *Requiem for a People* (Norman, OK: University of Oklahoma Press, 1978). The history of the Indians of the Rogue country.

Browning, Robert J., *Fisheries of the North Pacific: History, Species, Gear and Processes,* revised edition (Anchorage, AK: Alaska Northwest Publishing Co., 1980). An account of the fish, fishers, and fisheries of the North Pacific.

Carefoot, Thomas, *Pacific Seashores: A Guide to Intertidal Ecology* (Seattle, WA: University of Washington Press, 1977). An illustrated account of the ecology of the intertidal areas. Includes chapters on water movement, marine culture, marine pollution, and dunes.

Cole, Gerald A., *Textbook of Limnology,* 2nd edition (St. Louis, MO: C. V. Mosby Co., 1979). Introduction to the biological, chemical, and physical processes of lakes, ponds, and streams.

Fox, William, *At the Sea's Edge* (Englewood Cliffs, NJ: Prentice-Hall, 1983). An introduction to coastal oceanography for people who want to know more about the sea.

Goodwin, Harold, *Americans and the World of Water* (Newark, DE: University of Delaware, Sea Grant College Program, 1977).

Gross, M. Grant, *Oceanography,* 2nd edition (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1977).Combines the biological, chemical, and geological perspectives of oceanography into a world view of the oceans. An excellent reference book written in a nontechnical style.

Guberlet, Muriel Lewin, *Seaweeds at Ebb Tide* (Seattle, WA: University of Washington Press, 1974). The identification, uses, and lore of algae.

Haley, Delphine, *Marine Mammals* (Seattle, WA: Pacific Search Press, 1978). A collection of 21 articles that examine data, experiences, and observations about marine mammals.

Hart, J. C., *Pacific Fishes of Canada* (Hull, Quebec, Canada: Canadian Government Publishing Centre, 1980). An illustrated guide to Pacific fishes.

Hedgepeth, Joel, *Introduction to Seashore Life* (University of California Press, 1975). A well-illustrated guide to marine animals of the central California area.

Heitzmann, Ray, *Opportunities in Marine and Maritime Careers* (Skokie, IL: National Textbook Co., 1981). An examination of traditional, contemporary, and future marine careers and how to prepare for them. Written for high school and college students.

Hoyt, John, *Guide to Beaches* (Boston, MA: Houghton Mifflin Co., 1971). A short paperback that deals with the beach and shoreline processes.

Kozloff, Eugene N., *Seashore Life of the Puget Sound, the Strait of Georgia, and the San Juan Archipelago* (Seattle, WA: University of Washington Press, 1973). A description of marine organisms found around docks, pilings, rocky and sandy shores, and in bays.

Krauss, Robert W., ed., *The Marine Plant Biomass of the Pacific Northwest Coast* (Corvallis, OR: Oregon State University Press, 1977). Contains information on coastal morphology, water physics and chemistry, marine algae, seaweed farming, and resource development specific to Oregon.

MacGinitie, G. E., *National History of Marine Animals,* 2nd edition (New York: McGraw-Hill Book Co., 1968). A treatment of marine animal groups, their habitats and interrelationships.

McClane, A. J., *Encyclopedia of Fish Cookery* (New York, NY: Holt, Rinehart and Winston, 1977). Descriptions of world food fish; includes species identification, location, fishing techniques, cooking ideas, and indicators of quality.

McConnaughey, Bayard H., *Introduction to Marine Biology,* 3rd edition (St. Louis, MO: The C. V. Mosby Co., 1978). An ecological treatment of ocean organisms and their habitats, with sections on ocean evolution and human impact on the oceans.

McNeil, William J., and Daniel C. Himsworth, *Salmonid Ecosystems of the North Pacific* (Corvallis, OR: Oregon State University Press, 1980). Seventeen articles present current research on the freshwater and saltwater ecosystems that affect salmon survival and growth, on salmon population dynamics, and on artificial salmon propagation.

Parmenter, Tish, and Robert Bailey, *The Oregon Oceanbook: An Introduction to the Pacific Ocean off Oregon Including Its Physical Setting and Living Marine Resources* (Salem, OR: Oregon Department of Land Conservation and Development, 1985). See listing on page 13 for ordering information.

Rice, Tom, *Marine Shells of the Pacific Northwest* (Edmonds, WA: Ellison Industries, Inc., 1971). Identification guide with full-color plates.

Rickets, Edward F., Jack Calvin, and Joel W. Hedgpeth, *Between Pacific Tides,* 4th edition (Stanford, CA: Stanford University Press, 1968). A study of the protected and open coastlines, bays, estuaries, and open-ocean areas of the Pacific Coast. Discusses the organisms and physical processes that interact there. Could well be called the bible of marine ecologists.

Robbins, Chandler S., Bertel Bruun, and Herbert S. Zim, *Birds of North America,* revised edition (New York, NY: Golden Press, 1983). Guide to field identification of western birds of North America, including shore birds.

Ross, David A., *Introduction to Oceanography* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1977). A study of chemical, biological, and physical oceanography.

Scheffer, Victor, *Messages from the Shore* (Seattle, WA: Pacific Search Press, 1977). A collection of essays about the beauty and meaning of saltwater beaches and coasts.

Smith, Courtland, *Salmon Fishers of the Columbia* (Corvallis, OR: Oregon State University Press, 1979). The story of how the Columbia River salmon fishery has changed since the 19th century and the factors that have caused these changes.

Smith, Lynwood, S., *Living Shores of the Pacific Northwest* (Seattle, WA: Pacific Search Press, 1976). Illustrated guide to the marine environment and its inhabitants.

Snively, Gloria, *Exploring the Seashore in British Columbia, Washington, and Oregon* (Mercer Island, WA: The Writing Works, Inc., 1978). A guide to shore birds and intertidal plants and animals of the region. Color prints and drawings of the organisms are included, as well as descriptions of the various habitats and indigenous species.

Straton, Kathryn A., *Oregon's Beaches, A Birthright Preserved* (Salem, OR: Oregon State Parks and Recreation Branch, 1977). The story of how Oregon's beaches were preserved for public use.

Sumich, James, *Introduction to Biology of Marine Life* (Dubuque, IA: Wm. C. Brown). For use with advanced high school or freshman college students.

Thorson, Gunnar, *Life in the Sea* (New York, NY: McGraw-Hill Book Co., 1971).

Water and Man, Inc., *A Conceptual Framework for Water Education* (Salt Lake City, UT: Water and Man, Inc., 1981). 11 pp.

Wiedemann, Alfred M., LaRea J. Dennis, and Frank H. Smith, *Plants of the Oregon Coastal Dunes* (Corvallis, OR: Oregon State University Book Stores, Inc., 1969). Includes general description of the Oregon coastal dunes, various plant communities encountered there, and a key and description for each plant species.

## *Oregon State University Materials*

**Hatfield Marine Science Center.** Single copies of the publications listed in this section are available without charge; there is a small charge for additional copies. Send your questions and orders to:

Extension Marine Education Specialist
OSU Hatfield Marine Science Center
Newport, OR 97365 phone (503) 867-3011

1. Posters.

*So You're Going to the Beach?*
*Watch Your Step: Wet Rocks and Algae Are Slippery!* (SG 27)

2. Marine Education Tips.

*Plankton and the Food Chain*
*Measuring Ocean Depths—Ocean Floor 1*
*Bathymetric Contouring—Ocean Floor 2*
*Bathymetric Contouring—Ocean Floor 3*
*Sediment Plotting and Contouring—Ocean Floor 4*
*Sediment Contouring—Ocean Floor 5*
*A Drift-Bottle Experiment from R/V Yaquina Data—Ocean Currents 1*
*A Drift-Bottle Experiment You Can Do—Ocean Currents 2*
*Water Density: Its Role in Oceanic Circulation—Ocean Currents 3*
*Places of Interest to Visit and See on the Oregon Coast*
*The Changing Tides*
*Planning a Safe and Productive Field Trip to the Beach*

3. Publications of the OSU Extension/Sea Grant Program (next section) are available at the center.

4. These publications from other agencies are also available:

*A Guide to Oregon's Rocky Intertidal Areas* (ODFW Ed. Bul. 5)
*Cleaning and Cooking Octopus* (UC SG leaflet 21113)
*Upwelling in California Coastal Waters* (UC SG leaflet 2939)
*Marine Algae* (UC SG leaflet 21110)
*Photographing Tidepools* (SG reprint from *Sea Pen)*
*Gyotaku—Japanese Fish Printing* (UC SG leaflet 2548)

5. The center offers coloring books, posters, navigational charts, and curriculum materials at a small charge; and it houses a small but extensive bookstore.

**Extension/Sea Grant Program** publications are listed in this section—first, those available without charge, then those that are part of OSU's cost-recovery program. Different distribution policies apply in each case, and these are explained below.

Some general points:

1. An order of 100 or more copies of a single title will receive a 25% discount.
2. Whenever you send a check for OSU publications, please make it payable to "Oregon State University."
3. Send all inquiries, and orders for publications (both no-charge and priced), to:
   Bulletin Mailing Office
   Industrial Bldg.
   Oregon State University
   Corvallis, OR 97331-4202

*No-charge publications.* You may order up to 6 different no-charge publications without cost. Each publication beyond 6 copies will cost 10¢ plus postage and handling (25¢ for the first publication plus 20¢ for each additional publication in the same order).

SG 2 *Join the Wake Watchers*
SG 3 *Don't Bring 'em Back... Dead or Alive!*
SG 7 *Home Freezing of Seafood*
SG 14 *Bottomfishing off Oregon*
SG 26 *Getting Hurt on the Beach...* (poster)
SG 27 *Watch Your Step: Wet Rocks and Algae Are Slippery!* (poster)
SG 33 *Six Ways to Sink Your Boat*
SG 51 *Enjoy the Beaches—In Safety*
SG 52 *Gray Whales*
SG 53 *Watching Whales*
SG 57 *Coastal Bars Can Be Dangerous!*
SG 69 *Seal Pups Rest on Shore* (poster)
SG 76 *How to Identify a Soft-Shell Crab*

*Priced publications.* You may order as many as you wish. Please send your check or money order with your request. Please include 25¢ postage and handling for each publication (for 7 or more publications, please write for a postage quotation).

SG 8 *Continental Shelf Sediments Off Oregon,* 50¢
SG 9 *Phytoplankton, Grass of the Sea,* 25¢
SG 16 *Oregon's Nearshore Ocean,* 25¢
SG 25 *Understanding Tides,* 50¢
SG 28 *Oregon's Captivating Clams* (poster/folder), 25¢
SG 30 *Catching, Cleaning, and Cooking Bay Crabs,* 25¢
SG 35 *Oregon's Ever-Changing Coastline,* 50¢
SG 45 *Today's Youth in Tomorrow's Sea,* 50¢
SG 48 *What Are Salmon Worth?* 25¢
SG 58 *Flotsam, Jetsam, and Wrack on Oregon Beaches* (poster/folder), 25¢
SG 60 *Oregon's Tasty Mussels,* 25¢
SG 61 *Smelt Abounding! Dip Net to Dish,* 25¢
SG 62 *Squid for Supper!* 25¢
SG 63 *Intertidal Salt Marshes of Oregon,* 50¢
SG 68 *A Guide to Oregon's Commercial Fishing Vessels,* 75¢
SG 70 *Building a Small Crab Cooker for Home Use,* 25¢
PNW 212 *The Columbia-Snake: Challenges for Multiple-Use River Management,* 25¢
PNW 230 *Waterway User Fees and Wheat Transportation in the Pacific Northwest,* 25¢

Manual 2 *Identifying Oregon Driftwood* (52 pp., illustrated), $1.25. *Please note: for Manual 2 only,* send your order and check to: College of Agricultural Sciences, Fiscal and Personnel Office, OSU, Corvallis, OR 97331. Include 50¢ for postage for a single copy.

Manual 4 *Field Guide to Common Marine and Bay Fishes of Oregon* (60 pp., illustrated), $1.25

**Sea Grant College Program.** These publications are available at no charge. Send your orders to:

Sea Grant Communications, AdS 402A
Oregon State University
Corvallis, OR 97331 phone (503) 754-2716

*Coastal Aquaculture*

*Fish or Cut Bait*

*How to Help a Stranded Marine Mammal*

*Literature and the Sea*

*Oregon and Offshore Oil*

*Oregon State University Marine-related Publications*

*Sea Grant at OSU: The First 15 Years*

*Sea Grant Biennial Report*

*Sea Grant Project Directory*

*The Oregon Oceanbook* was coproduced with the Oregon Department of Land Conservation and Development. Well illustrated and written in plain language, it describes the ocean off Oregon's coast—its geology and ecosystem, its marine birds and mammals, its nekton and plankton, its physical characteristics. *The Oregon Oceanbook* is available without charge; to obtain a copy, write the Marine Education Specialist, OSU Hatfield Marine Science Center, Newport, OR 97365.

## *California and Washington Publications*

*Publications Catalog* (Special Publication 2030). Available from: Agricultural Sciences Publications, University of California, 1422 Harbour Way S, Richmond, CA 94804.

*Catalog of Marine Publications.* Available from: Sea Grant Communications, University of Washington, 3716 Brooklyn Ave. NE, Seattle, WA 98105.

## *Newsletters and Journals*

*Alaska Earthlines/Tidelines.* A monthly newsletter for students with excellent coverage of marine topics. Alaska Geographic Society, Anchorage, AK.

*Clearing: Creative Resources in Environmental Education.* Published bimonthly by the Environmental Education Project, School of Education, Portland State University, Portland, OR 97207. Membership in Northwest Association of Marine Educators includes a subscription to this journal. For information about NAME, write to: Extension Marine Education Specialist, OSU Hatfield Marine Science Center, Newport, OR 97365.

*Current: The Journal of Marine Education.* Quarterly publication of the National Marine Education Association. P.O. Box 666, Narragansett, RI 02882. Membership in the Northwest Association of Marine Educators and National Marine Education Association includes a subscription to this journal. (For more information, see previous entry.)

*Ocean Law Memo.* Publication of the University of Oregon Ocean Resources Law Program. Subscription free on request from Oregon State University, Extension/Sea Grant Program, AdS 422A, Oregon State University, Corvallis, OR 97331.

*Oceans.* Bimonthly journal of the Oceanic Society, Fort Mason, San Francisco, CA 94123. Write for subscription information.

*Oceanus.* Published quarterly by Woods Hole Oceanographic Institution, Woods Hole, MA 02543. Write for subscription information.

*Nautica.* Magazine of the sea for young people. Published by Nautica Magazine, Pickering Wharf, Salem, MA 01970.

*The Oregon Coast.* Published periodically by the Oregon Coastal Zone Management Association, PO Box 1033, Newport, OR 97365. Land use and resource-related articles, events, and announcements. Subscription free on request.

*Oregon Geology (*formerly *The Ore Bin).* Published monthly by the Oregon Department of Geology and Mineral Industries, 1069 State Office Bldg., Portland, OR 97201. Often has articles on marine geology and resources. Write for subscription information.

*Oregon Planning News.* Bimonthly newsletter of the Department of Land Conservation and Development, 1175 Court St. NE, Salem, OR 97310. Free on request.

*Sea Pen.* Periodic publication of the Marine Science Society of the Pacific Northwest, PO Box 10512, Bainbridge Island, WA 98110. Articles on a wide variety of marine topics. Subscription included in membership.

*Sea Squirt.* Newsletter of the Marine Science Society of the Pacific Northwest, PO Box 10512, Bainbridge Island, WA 98110. Subscription free on request.

## *Organizations*

American Cetacean Society
Los Angeles Chapter
PO Box 2698
San Pedro, CA 90731

Environmental Education Association of Oregon
PO Box 40047
Portland, OR 97240

Greenpeace Foundation
55 West 13th
Eugene, OR 97402

Institute of the Rockies
(Columbia River Watch)
622 Evans St.
Missoula, MT 59801

Marine Science Society of the Pacific Northwest
PO Box 10512
Bainbridge Island, WA 98110

National Marine Education Association (NMEA)
PO Box 666
Narragansett, RI 02882

Northwest Association of Marine Educators (NAME)
c/o OSU Hatfield Marine Science Center
Newport, OR 97365

Oceanic Society
Fort Mason Center
San Francisco, CA 94123

Oregon Shores Conservation Coalition
PO Box 578
Rockaway, OR 97136

Pacific Estuarine Research Society
USFS, Suite 1962
500 NE Multnomah St.
Portland, OR 97232

Sea Heritage Foundation
254-26 75th Avenue
Glen Oaks, NY 11004

## *A-V Sources*

The Portland State University Continuing Education Film Library has over 120 marine education films available for rent, from $9 to $15 per film. Film catalogs are issued to school libraries; libraries may request a copy. Write to:

1633 SW Park Ave.
PO Box 1383
Portland, OR 97207 phone (503) 229-4890

The Oregon State University Hatfield Marine Science Center loans slide sets with scripts to schools. See page 16 for a list of these sets.

Many education service districts maintain collections of films, filmstrips, and other media.

Most educational and professional journals contain information about new media available.

Public agencies and some private industries often distribute films and other A-V materials about their work.

(See also "Oregon river and stream materials," next section.)

## *Oregon River and Stream Materials*

A number of audiovisual and printed materials are available. Write the agency or organization listed for more information.

**Bureau of Land Management** offers *Livable Streams,* a 15-minute slide-tape on the relationship between land use and stream water quality. Grade 9 to adult. Available from the Bureau's Public Affairs Office, PO Box 2965, Portland, OR 97208; phone (503) 231-6273.

**Modern Talking Picture Service, Inc.,** offers three films. Write to them at: 5000 Park St. N, St. Petersburg, FL 33709.

*Blue Rock,* an award-winning film about water use and management.

*Mount St. Helens Eruption Recovery* documents the restoration of rivers affected by the 1980 eruption.

*The New Willamette,* an award-winning film about the cleanup of the Willamette River.

**Northwest Power Planning Council** offers *Journey of the Kings,* a 15-minute film about salmon on the Columbia River. Available from the Council, 850 SW Broadway, Suite 1100, Portland, OR 97205. Free on request.

**Oregon Department of Fish and Wildlife.** For information on the biological aspects of rivers and streams, write ODFW, 506 SW Mill St., Portland, OR 97201.

**Oregon Department of Water Resources.** For information on river and stream water appropriations, use, flow, etc., contact ODWR, 555 13th St. NE, Salem, OR 97301; phone (503) 378-3671.

**OSU Hatfield Marine Science Center** has two slide-tape sets. Available from Extension/Sea Grant Program at the center, Newport, OR 97365.

*Run, River, Run* deals with streams, salmon, and stream habitat improvement. Two-projector, synchronized slide presentation.

*Stream Enhancement* shows what's involved in enhancing stream habitats in the Northwest.

**U.S. Army Corps of Engineers** materials provide a variety of resources for schools on stream and river topics. Write the Corps' Portland District, Public Affairs Office, PO Box 2946, Portland, OR 97208.

## *OSU Extension Marine Agents and Specialists*

Extension marine agents are valuable sources of local marine information. Extension marine specialists have varying areas of expertise. Listed here, first, are the county offices where agents are located (north to south on the Oregon coast plus northern California); then Portland and Vancouver, Washington; and finally the OSU campus in Corvallis.

Astoria 97103 (503) 325-8573
Extension Marine Agent
Clatsop County Office
OSU Extension Service
PO Box 207

Tillamook 97141 (503) 842-5511
Extension Marine Agent ext. 372
Tillamook County Office
OSU Extension Service
2204 4th St.

Newport 97365 (503) 265-3463
Extension Marine Agent
Lincoln County Office
OSU Extension Service
29 SE 2nd

OSU Hatfield Marine Science Center (503) 867-3011
Extension Marine Education Specialists ext. 226
Extension Marine Mammals Specialist
Extension Seafood Technologist

Coquille 97423 (503) 396-3121
Extension Marine Agent ext. 240
Coos County Office
OSU Extension Service
Courthouse Annex, 290 N Central

Crescent City, CA 95531 (707) 464-4711
Extension Marine Agent
Del Norte County Extension Office
981 H St.
*(for events in Curry County, Oregon; cosponsored by the OSU Sea Grant Program)*

Portland 97215 (503) 254-1642
Extension Marine Agent
Extension Marine Specialist
(Columbia River fisheries)
Multnomah County Office
OSU Extension Service
211 SE 80th

Vancouver, WA 98665 (206) 696-6018
Area Specialist (Columbia River questions)
Washington Sea Grant
1919 NE 78th St.
*(cosponsored by the OSU Sea Grant Program)*

Corvallis 97331
Oregon State University
Extension Coastal Resources Specialist (503) 754-3771
Extension Fisheries Engineering Specialist (503) 754-2041 ext. 44
Extension Marine Communications Specialist (503) 754-3311
Extension Marine Economics Specialist (503) 754-2942

# Marine Education Field Sites

## *Oregon State University Hatfield Marine Science Center*

The Hatfield Marine Science Center (HMSC) in Newport is composed of eight units: public wing, library-instructional building, NOAA National Marine Fisheries Service, NOAA National Marine Fisheries Research Support Facility (Newport Aquaculture Laboratory), Oregon Department of Fish and Wildlife (marine headquarters), U.S. Environmental Protection Agency (marine division), and ship support systems. While each unit has its own defined mission, the center operates as a cooperative and coordinated whole.

Public education is an important function of the center. Responsibility for public education programs is vested in the public wing; it is a part of the Extension/Sea Grant Program associated with the Sea Grant College Program. Operational and administrative funds come through the School of Oceanography and the OSU Extension Service.

A major portion of the educational effort is devoted to working with school groups from kindergarten through college. Each year, thousands of students representing hundreds of schools visit the center and take part in its programs.

If you wish to visit the center and use its programs, please write or call the schedule secretary, OSU Hatfield Marine Science Center, Newport, 97365, (503) 867-3011. Information needed is: (1) name of school and district; (2) grade level(s); (3) preferred date; (4) arrival time; (5) number of students, teachers, and other adults. Confirmed reservation will be by mail. Every attempt is made to accommodate all of those who wish to participate in the programs; however, it sometimes happens that rearrangements must be made. There is no charge for the programs.

**Indoor Programs.** To help make effective use of your time at the museum-aquarium, a six-level student guidesheet has been developed. Guidesheets help students focus their attention on museum-aquarium subjects and stimulate responses. Guidesheets are developed for K-2, 3-4, 5-6, junior high, high school, and advanced biology students. Guidesheets may be obtained before your visit.

The center aquarium display normally contains about 110 (numbers higher in summer) of our shore, bay, and shell species. The 11,000-gallon display consists of 17 tanks ranging in volume from 2,500 to 5 gallons. The center lacks facilities for marine mammals, but most other groups of marine animals are represented. Students can touch and examine sea stars, sea anemones, sea urchins, crabs, snails, chitons, etc., in the popular touch tank. Even an octopus is available for viewing in a separate tank. In addition, the HMSC contains many museum panel displays that offer students opportunities to learn about a wide variety of concepts.

On scheduled visits, groups are met in the auditorium by a member of the staff who presents a short history of the HMSC and the work currently being done there. The guidesheet exercise is then explained, and the group goes into the museum-aquarium section. For help in following the guidesheets, center staff depend on teachers and other adults in the group.

After responding to the questions and experiencing the touch tank, all reassemble in the auditorium, where the staff member will lead a question and answer session. The length of time spent at the center may vary from 1½ to 2 hours.

Group visits are scheduled on a first-call-first-served basis. The auditorium can seat 180 people; however, with schools, the HMSC prefers small groups. During the spring, several schools may be using the facilities simultaneously.

The center staff has noted that when groups have had some previsit introduction to marine science, their visits are more likely to be educationally profitable. Thus, the staff recommends that teachers use appropriate marine science materials and films before their visit. The staff has also found that when a class is organized into groups of six to eight students under the leadership of an adult, there is greater potential for learning.

Groups bringing sack lunches must plan to eat on their buses or in one of the nearby parks or waysides, as the center has no lunchroom facilities.

**Outdoor Programs.** *Tidepooling at Yaquina Head.* This unique experience allows students to visit a tidepool, get their feet wet, and become familiar with most of the common animals and plants typical of rocky intertidal areas in the Pacific Northwest. The tidepooling experience can be combined with observations of

the bird colonies on the offshore islands and a brief explanation of the geological formations in the area.

*Commercial boat dock tour.* This program offers a tour of the commercial boat docks on the Newport waterfront. The types of commercial fishing vessels and rigs will be identified by observing different onboard gear. The program will give students an appreciation of the economic importance of Oregon's commercial fishery and offer insight into the life of a fisher.

This experience is offered fall and spring only and is not suitable for students younger than grade 5. Limit group size to 30.

*Estuary field trip.* This activity offers students a hands-on lesson in estuarine ecology. They will learn about interrelationships between estuarine habitats and how each plays a role in supporting marine life. During a nature hike along the shores of Yaquina Bay, the students will collect samples of plant and animal life from mud flat and salt marsh habitats.

The program is recommended for grades 4 through 12. The total session takes about 2½ hours. A nature hike only is 1 hour. Group size is limited to 30. This activity is offered spring and fall when the tide is + 5 or lower.

**Slide Sets** with scripts may be borrowed for 1 week at no charge. Use the slides to prepare your students for their HMSC visit. Sets recommended for programs are:

Indoor program: *Intertidal Animals*
Tidepooling: *Intertidal Animals*
*Geological Formations*
Estuary field trips: *Salt Marshes*
Commercial boat dock tour: *Oregon's Commercial Fisheries*

Reserve the slide sets by contacting receptionist, HMSC, (503) 867-3011.

**Teacher checklist for HMSC visits.**

1. Have safety rules been explained? (See "At the Water's Edge," page 21.)
2. Have you provided a map for the bus driver?
3. Are students properly clothed?
4. Have you checked weather conditions?
5. If you must cancel your visit—or if you will arrive late—have you phoned HMSC?
6. Is a parent phone list handy for late returning to school?
7. Do you have slide sets that you should return to the center during your trip?

**Seatauqua Program.** The center each summer schedules films, talks, workshops, and nature walks for the general public. These events are designed to familiarize persons of all ages with the marine environment, industry, art, and culture. A poster/schedule is usually ready in April; write the center for a copy.

**Other Programs.** New programs dealing with a variety of marine topics are constantly being offered at the HMSC throughout the year. You can be kept informed about these programs by asking the center to place your name on its general mailing list.

## *Other Oregon Sites*

**Astoria-Seaside Area**

Fort Clatsop
Rt 3, Box 604
Astoria 97103 (503) 861-2471

Fort Clatsop is a national monument to Lewis and Clark. There is a visitors' center anda replica of the fort that Lewis and Clark built to spend the winter. A program for school groups includes the film *Journal of Lewis and Clark,* discussion and demonstration of articles that Lewis and Clark might have used (students have a chance to examine these), and a loading demonstration of a flintlock rifle. Groups of 50, 30, or fewer preferred. Time required: 1½ hours. No charge.

Clatsop County Historical Museum
441 8th Street
Astoria 97103 (503) 325-2203

Tour of museum. Museum displays include Indian artifacts, various antiques, and articles from ships. Any group size. Time required: 30 min. No charge.

Columbia River Maritime Museum
16th and Exchange Sts
Astoria 97103 (503) 325-2323

The museum preserves artifacts of entire Columbia River. Maritime history displays include ship models, pictures of early explorer ships, and shipwrecks around the Columbia River mouth. Another exhibit is the retired lightship 88, which served as a beacon off the Columbia River bar. Visitors to the museum may tour the ship. Free previsit teacher's packet will be sent on request. With advance request, the program can be altered to your needs. Any group size. Time required: Museum, 45 min.-1 hour; lightship, 20-30 min. Small charge.

Fort Stevens State Park

Within the park are salt marshes, deflation plain with freshwater lake, and sand dunes. Ecological succession of dunes to spruce forest can be demonstrated in this area. Hiking trails, bike paths, and camping facilities are available. The *Peter Iredale* shipwreck is visible from the beach here.

Lewis and Clark Wildlife Preserve

This area is inaccessible except by boat. It includes all the major islands, bays, and sloughs of the Columbia River above the Tongue Point area to Westport. The island marshes and surrounding habitat provide cover for waterfowl and are the last refuge for the Columbia River whitetail deer.

Tillamook Rock Lighthouse

Situated on an island just south of Tillamook Head, this is one of the most inaccessible and battered lighthouses on the West Coast. Its construction was one of the most difficult tasks undertaken by the Lighthouse Board. Several workmen drowned as construction crews tried to land on the island; the building site had to be blasted out of the rock. Winter storms batter the island, and it is reported that one storm hurled a 135-pound boulder through its roof. The lighthouse has been replaced by a radar buoy ½ mile seaward. It is now used as a columbarium.

**Tillamook Area**

Garibaldi fishing fleet

A variety of commercial fishing vessels can be seen at the docks.

Smith Pacific Shrimp Co.
Bay City 97107 (503) 322-3316

A viewing area allows visitors to watch the entire shrimp-processing operation. Shrimp are cooked, shelled, packaged, and readied for distribution to markets in Portland and San Francisco. The shrimp season opens in April; production depends on the supply. Shrimp boats fish only during good

weather. A call a day or two before a trip to the coast will determine if the plant will be in operation. Any group size. Time required: varies. No charge.

Tillamook Pioneer Museum
2106 2nd Street
Tillamook 97141 (503) 842-4553

The museum has a variety of antiques, wildlife dioramas, natural history displays, rock and mineral rooms, and Indian and logging displays. Any group size. Time varies. No charge (donation box).

Tillamook Spit area

This sand spit forms the western boundary of Tillamook Bay. Situated on it in the early 1900's was a small resort community, Bay Ocean. After the north jetty was built, erosion of the spit area occurred to such an extent that the community was washed into the sea. Pieces of concrete and water pipe from the houses can still be found on the spit. A 1-mile hike is required to reach the spit area. Pictures of the Bay Ocean community are displayed at the Bar View Store on Highway 101 north of Garibaldi.

Cape Meares Lighthouse

The original structure of the Cape Meares Lighthouse, a popular tourist attraction, is not in operation; it has been replaced by a more efficient, smaller structure built in 1963. Cape Lookout was originally surveyed and set aside by the Federal Government as a lighthouse reserve, but because of an error by the survey party, the light was built on Cape Meares. Materials to build the lighthouse were brought in by teams of oxen; the bricks were made from clay at the site; and local timber was used for its construction.

Octopus tree

At the same location as the Cape Meares Lighthouse stands a huge, deformed tree referred to as the "octopus tree." It is theorized that Indians used the tree as a burial site, that they placed their dead in canoes hoisted into the limbs of the tree, causing it to grow in unusual patterns. Others claim that high winds in the area caused the deformations.

Blimp hangars

Blimp hangars from World War II can be seen from highway 101 south of Tillamook.

**Depoe Bay Area**

Fishing fleet

Commercial fishing vessels, Coast Guard rescue boats, charter boats, and sports craft are frequently moored at the docks.

**Newport Area**

Devils Punch Bowl State Park

North of Newport at Otter Rock, this park lies in an area of high erosion. The surf has shaped a large "bowl" with two entrances in the rock.

Yaquina Head Lighthouse

This lighthouse, 3 miles north of Newport, was built in 1873 in the wrong location. It was planned for Cape Foulweather, the next headland to the north; because of a confusion of names (Yaquina Head was also called Cape Foulweather), the materials were landed at the wrong location. Although the structure was commissioned in 1873, it is still in near-perfect condition. There are bird rookeries on offshore rocks in spring and summer.

Lincoln County Historical Museum
545 SW 9th
Newport 97365 (503) 265-7509

The museum offers school tours that include a brief talk about Indian and pioneer life in Lincoln County. An Indian legend is related to the youngsters around the fireplace. Indian artifacts and various antiques are on display, many of which are in a log cabin and in the Burrows House, a Queen Anne-style home. Group size: 15-20. Time: 30 min. No charge.

OSU Hatfield Marine Science Center (see page 15)

Fishing fleet

Newport is one of the major ports of Oregon's commercial fishing fleet. Vessels that fish for salmon, tuna, crab, shrimp, and bottomfish may be seen on the waterfront at Newport, as well as charter boats, sports craft, and occasional freighters.

Yaquina Bay Lighthouse

Located at the north entrance to Yaquina Bay, this light was constructed in 1871 and was closed in 1874. The construction of the Yaquina Head Lighthouse, built just 3½ miles to the north, made this lighthouse unnecessary. It has now been converted to a museum, and the lighthouse keeper's house is furnished as it was during the days of its use. There is no charge to see the museum; school tours are not offered.

Jump-Off Joe

A massive landslide occurred here during the 1940's. This area is an example of the geologically hazardous areas in the central coast region; land is continually lost to the sea.

**Yachats Area**

Cape Perpetua Visitors' Center
PO Box 274
Yachats 97498 (503) 547-3289

This facility, maintained by the U.S. Forest Service, has a naturalist on duty to conduct studies of various nature trails for groups. Hiking tours from ½ to 5 miles (round trip) in length can be taken. Some are guided, some use signs along the route, and one uses a cassette tape presentation as a guide. A 22-mile auto trip from the center to Yachats is also available. Displays in the center include a slide show that identifies local plants and animals and a diorama of the Suislaw National Forest. Films are shown in a 50-seat auditorium. Guided tidepool studies are also offered. Group size: 20. Time: 1-2 hours. No charge. Make reservations. See also page 20.

**Florence Area**

Heceta Head Lighthouse

This lighthouse was constructed in 1894. Bricks and cement for the tower were shipped by sailing vessel from San Francisco to Florence, then transported by teams of horses and wagon to the site. Lumber was shipped by Oregon mills to the Siuslaw River, then rafted to the site. It was named for an early Spanish explorer and is one of the most picturesque lighthouses on the Oregon coast.

Darlingtonia Wayside

Four miles north of Florence on Highway 101, the wayside is an interesting botanical site. A boardwalk has been built over a bog in which many pitcher plants grow. These unique plants trap and feed on insects. A hike through the bog will take about 15 minutes.

**Reedsport Area**

Umpqua River Lighthouse

Built in 1857, this was the first lighthouse site in the Oregon Territory. The original structure was abandoned and it eventually washed away as its sand foundation eroded. The present lighthouse was built in 1894, on higher ground south of the river entrance.

Salmon harbor (Winchester Bay)

During the summer, numerous recreational boats and a large charter fleet operation can be observed.

Oregon Dunes National Recreation Area
Headquarters
855 Highway Ave
Reedsport 97467 (503) 271-3611

Reaching from Florence to Coos Bay is the earth's largest temperate zone sand dune sheet associated with an ocean. The ODNRA headquarters offers school programs on the geology, ecology, management, and history of the dunes. The programs can be tailored to a variety of ages and needs, and can be offered at any location (Florence to Coos Bay) in the dunes area. Previsit and postvisit materials, including slide and film presentations, are available. Programs can be scheduled in spring, summer, or fall by contacting the headquarters. Group size: any—however, be prepared to divide large groups into smaller learning groups. Time varies with presentation. No charge.

**Coos Bay Area**

Coos-Curry Museum
Simpson Park
North Bend 97459 (503) 756-6320

Special school tours are not available. The museum offers a general line of exhibits including flag display, Indian artifacts, library, musical instrument artifacts, wagons, and farm implements. Group size 40-80. Time: 30 min.-1 hour. No charge.

Coos Bay-North Bend waterfront

Numerous ships and barges load logs, lumber, or chips here for export.

Charleston small boat basin

This is the home of one of Oregon's largest commercial fishing fleets. Vessels may be observed at the docks or unloading salmon, tuna, crab, shrimp, or bottomfish at one of the five processing plants.

Shore Acres State Park

Shore Acres, in the Coos Bay area, is the former estate of lumber baron Asa M. Simpson. The park includes gardens maintained as they were in Simpson's days. Tennis courts and other remnants of the estate can still be seen. Picturesque cove and rocky reef make up the beach area. Stephen Dow Beckham's *Simpsons's of Shore Acres* traces the rise and fall of the Simpson fortune and includes drawings and photographs of the Simpson house and estate.

Cape Arago Lighthouse

Located on a small island, this lighthouse is connected to the mainland by a narrow foot bridge. It is equipped with fog signal and radio beacon and acts as a landfall and harbor entrance beacon. This structure was built in 1934 and is the third light on this site; the two earlier ones were lost to erosion. The edge of the cliff is moving ever closer to the present structure; a fourth one may some day be necessary.

Horsfall Park

The park encompasses a sand dune area; look for such dune features as foredune, deflation plain, freshwater lake, secondary dunes, and a succession of plant communities.

South Slough Estuarine Sanctuary
PO Box 5417
Charleston 97420 (503) 888-5558

This 4,400-acre of tidelands, water, and uplands is the nation's first estuarine sanctuary. An onsite education specialist supervises education programs at the visitors' center. There is limited overnight housing for groups with interest in estuarine topics.

**Bandon Area**

Coquille River Lighthouse

The Coquille Lighthouse, located halfway out on the north jetty of the Coquille River, was built in 1895; it was abandoned in 1935, replaced by a small automatic light on the south jetty of the river. Several attempts have been made to refurbish and keep the sentinel as a historic site.

**Port Orford Area**

Cape Blanco Lighthouse

Situated on the most westerly point of Oregon (at the end of a road 6 miles northwest of its junction with U.S. 101, 6 miles north of Bandon), the Cape Blanco Lighthouse was built in 1870 and is in a remarkable state of preservation. There is also a Loran station here (a radio tower that broadcasts navigation information for vessels off the coast). Sea otters were transplanted here in 1970-71.

Port Orford docks

Because no natural harbor exists, commercial fishers keep their vessels on large trailers and hoist them in and out of the sea daily.

**Gold Beach Area**

Curry County Historical Museum
Fairgrounds, South Ellensburg
Gold Beach 97444 (503) 247-6113

Displays show periods of Curry County history, sea otter pelts, murre eggs. Special tours are available at times when museum is not open. Group size: up to 100. Time: varies. No charge.

**Brookings-Harbor Area**

Boat docks

A variety of commercial and sports boats can be viewed at the boat docks in Brookings.

Wheeler Creek Redwood Natural Area

Located 25 miles east of Brookings, this is the northernmost grove of coast redwoods *(Sequoia sempervirens).* For information about the area, write to the District Ranger, U.S. Forest Service, Chetco Ranger District, Brookings 97415, (503) 469-2196.

**Portland Area**

Port of Portland Tour (503) 231-5000

A tour of marine terminals and dock activities illustrating the importance of the port to Oregon's economy. Groups must be in one vehicle and provide their own transportation (e.g., a school bus). Make reservations with Administrative Coordinator for Public Affairs, Port of Portland. Group size: *at least 30.* Age limits: Grade 3-adult. Time 2-2½ hours. No charge.

Port of Portland mobile van (503) 231-5000

A traveling van that provides a look at the activities of the port. The van operates in the tricounty area only and alternately serves one county each year. Make arrangements with Administrative Coordinator for Public Affairs, Port of Portland. Ages: Grades 3-5. No charge.

## *Coastal Outdoor School Sites*

Almost all outdoor school sites in Oregon lend themselves to the study of some body of water, be it river, pond, lake, or stream. The sites in table 1 offer the ocean.

Additional information about outdoor school sites is available from the Environmental Education Project, Portland State University, P.O. Box 751, Portland, (503) 229-4721, or from *Living Education: A Teacher's Guide to Overnight Sites in Oregon* (Oregon Department of Education, Salem, 1975; available on request).

Table 1.—Some Oregon coastal outdoor school sites

| Site | Contact | When available | Approximate student capacity | Accommodations |
|---|---|---|---|---|
| Camp Baker<br>1562 Boy Scout Rd.<br>Florence 97439<br>(503) 997-3526 | Oregon Trail Council<br>Boy Scouts<br>2525 Centennial Blvd.<br>Eugene 97401<br>(503) 485-4433 | March-<br>December | 200 | dining hall, 3-sided cabins, tent sites |
| B'Nai B'Rith<br>Devil's Lake<br>Neotsu 97364<br>(503) 994-2218 | Camp Director<br>Jewish Community Center<br>6651 SW Capitol Hwy.<br>Portland 97214<br>(503) 244-0111 | Fall<br>Winter<br>Spring | 150 | lodge, kitchen, cabins, recreation building, pool |
| Breakaway Lodge<br>Gearhart 97138<br>(503) 783-9983 | Young Life<br>1804 NE Halsey St.<br>Portland 97332<br>(503) 282-2225 | Year-round<br>(weekends only) | 60 | lodge, kitchen, lounge; cook available |
| Camp Cleawox<br>04595 Mitchel Loop Rd.<br>Florence 97439<br>(503) 997-3040<br>(summer only) | Western Rivers Girl Scouts<br>2055 Patterson, Room A<br>Eugene 97405<br>(503) 485-5911 | September 1<br>to June 1 | 80 | Adirondack shelters, lodge-dining hall, shower house |
| Heceta Head Lighthouse<br>Florence 97439 | Lane Community College<br>4000 E 30th<br>Eugene 97405<br>(503) 747-4501 ext. 2558 | Year-round | 25 | lodge with divided sleeping quarters, dining hall |
| Camp Kiwanilong<br>Near Fort Stevens and<br>Warrenton | Ranger, Camp K<br>Clatsop County Youth Camp<br>Route 1, Box 344<br>Warrenton 97146<br>(503) 861-2933 | Year-round | 96 | lodge, dining hall, kitchen |
| Camp Magruder<br>17450 Old Pacific Hwy.<br>Rockaway 97136<br>(503) 355-2310 | United Methodist Church<br>Center<br>1505 SW 18th Ave.<br>Portland 97201<br>(503) 226-7931 | Year-round | 150 | auditorium, 7 lounges, cabins, shower houses, kitchens |
| Camp Meriwether<br>17500 Cape Lookout Rd.<br>Cloverdale 97112 | Columbia Pacific Council<br>Boy Scouts<br>Director of Properties<br>2145 SW Front Ave.<br>Portland 97201<br>(503) 226-3423 | Fall<br>Winter<br>Spring | 250 | lodge, enclosed cabins, kitchen |
| Neskowin Crest Research<br>Natural Area<br>Cascade Head Summit | District Ranger<br>Hebo Ranger District<br>Siuslaw National Forest<br>Hebo 97122<br>*or*<br>U.S. Dept. of Agriculture<br>Forestry Sciences Laboratory<br>3200 Jefferson Way<br>Corvallis 97331<br>(503) 757-4429 | Year-round | N/A | research area in Sitka spruce and western hemlock; Neskowin Creek Forest Camp nearby has primitive campsites |

Table 1.—Some Oregon coastal outdoor school sites (continued)

| Site | Contact | When available | Approximate student capacity | Accommodations |
|---|---|---|---|---|
| Cape Perpetua Campground<br>Yachats 97498 | Visitor's Center<br>U.S. Forest Service<br>(503) 547-3289 | September to May | 37 campsites<br>1 group area | campground with restrooms; kitchen, interpretive program available |
| Camp Rilea<br>Route 1, Box 497E<br>Warrenton 97146<br>(503) 861-3341 | Armory Facilities Coord.<br>Military Dept., State of Oregon<br>Salem 97303<br>(503) 378-6130 | September to May | 150 | new armory with classroom, restrooms, kitchen facilities |
| Sitka Center for Art and Ecology | Sitka Center<br>PO Box 65<br>Otis 97368<br>(503) 994-5485 | Year-round | 30 | lodge, kitchen, no overnight use, campgrounds nearby, has summer program of cultural classes |
| Twin Rocks Friends Camp Conference, Inc. | Executive Director<br>18705 Hwy. 101 N<br>Rockaway 97136<br>(503) 355-2245 or 355-2284 | September to June | 200 | cabins, lodge-type dorm, dining hall with large lounge |
| Camp Westwind<br>Route 2, Box 21<br>Otis 97368 | Camp Administrator<br>YWCA of Portland<br>1111 SW 10th Ave.<br>Portland 97204<br>(503) 223-6281 ext. 207 | Fall<br>Winter<br>Spring | 150 | newly remodeled lodge and kitchen, cabins, arrival and departure by boat |
| William's Hall (Chapel by the Sea)<br>PO Box 25<br>Lincoln City 97367 | Presbyterian Church<br>3258 SW Beach Ave.<br>Lincoln City 97367<br>(503) 996-2070 or 996-2453 | Year-round | 53 | dorms, lodge, kitchen |
| WI-NE-MA Christian Camp, Inc.<br>5195 WI-NE-MA Rd.<br>Cloverdale 97112<br>(503) 392-3362 | Manager<br>5195 WI-NE-MA Rd.<br>Cloverdale 97112<br>(503) 392-3362 | Year-round | 180 | small lodge, dorms, gym/meeting room, kitchen |

# At the Water's Edge

## *Safety*

(This section is adapted from *Planning a Safe and Productive Field Trip to the Beach,* Oregon State University Extension Service, Marine Science Education Tip; Corvallis, 1977).

Water in lakes, streams, ponds, rivers, or oceans is a good friend; it can also be a deadly enemy when carelessness prevails. It is important to learn, and to teach your students, respect for water.

Drowning is a leading cause of accidental death. It occurs not only among recreational swimmers, but also among those who use small watercraft, among young people who play along docks and shores of all bodies of water, among children who are left unsupervised and wander into ponds and canals, and among skaters who break through ice.

Drowning is not the only danger water offers. Water makes rocks, ledges, and docks slippery. It can undercut banks, making them unstable. It can move heavy objects on top of people. It can hide dangers like broken glass. It can lower your body temperature to a lethal level. Identify and warn students about these dangers *before* your visit to the water's edge.

All bodies of water can be dangerous, but the ocean deserves special caution. The seashore is a unique environment, one that is popular with schools for field trips. Because of its unique nature, a field trip to the beach requires extensive and special preparation. Educational activities and conservation practices must be well planned and instilled in the students before the trip. *Safety is always a concern of any teacher.*

Be aware of the potential dangers on the beach. Drift logs, steep and crumbly trails, treacherous waves, and incoming tides all must occupy a leader's attention. Consider this checklist before students embark on the buses for a trip to the seashore:

1. Take only a manageable group to the beach. If your group is larger than 30 students, be sure to include an adequate number of properly briefed chaperones to help keep an eye on energetic students. One adult for every 10 students is a safe ratio.
2. Be sure students are dressed properly for the trip. Long pants and tennis shoes (or rubber boots) are musts. Warm jackets are a good idea, as it is almost always chilly at the beach.
3. Be sure a first-aid kit is available for minor cuts and abrasions that may occur.
4. Visit the site of the field trip before the trip date.
5. Study the tidetables; plan to arrive at the beach *an hour before low tide.* It is safer to be on the beach with an outgoing tide.
6. Check weather conditions before starting the trip; a stormy winter beach, with waves pounding, is not a place to take a group of students. Seas 8 feet and above are considered dangerous; be especially careful to keep a good distance from the water line if you are on the beach under these conditions.
   - For the *Newport* area, call (503) 265-5511 for the current Coast Guard recording of wind, temperature, and weather, wave, and surf conditions.
   - For the *Astoria* area, call (206) 642-3565.
   - For the *Coos Bay* area, call (503) 888-3102.
7. Insist that students stay away from drift logs near the water. Logs are easily moved by only a small amount of water, *and every year people are crushed by rolling logs.*
8. *Never build a fire in the drift logs.* It can spread through the driftwood area.
9. Beach trails are often slippery and steep. Station chaperones at intervals for an orderly descent to the beach.
10. Always be alert for extra large "sneaker waves" when on the beach.
11. Assign one of the chaperones to a "wave and tide" watch while on the beach. Don't let the incoming tide trap you or any of the group on a rock or ledge.
12. Keep students off rock pinnacles for they are steep and dangerous. Many are bird refuges, and it is against the law to disturb the birds.
13. Rip currents are a reality. Never allow students to wade or swim while on the field trip. Strong rip currents run out to sea and can carry inexperienced swimmers with them.
14. Assign the students to a buddy system while at the beach.

## *Conservation*

Rocky tidepool areas are limited in size; thousands of students visiting these areas during the spring low tide series can cause problems from overuse. Emphasize conservation practices to the students before you leave the classroom.

1. Squelch the "save it and take it home" impulse. The replacement rate of some of the animals is not very rapid, and your collecting may deprive other students from ever seeing the more unusual species.
2. Check the current angling regulations for information about tidepool animals. Or check with the Department of Fish and Wildlife, Marine Science Drive, Newport 97365, (503) 867-4741, for information about regulations and collecting permits. Under certain conditions, it is lawful to collect for a classroom aquarium or other selected educational purposes.
3. Be sure students return rocks when they pick them up to reveal hidden animals. Tubeworms, sponges, and other sessile animals live there for protection; they will die if left exposed.
4. Be sure students replace creatures they pick up to the spot where they found them. Some animals have specific feeding requirements, and they live at specific tidal heights. Moving them to another part of the beach can kill them just as surely as removing them *from* the beach.
5. Have students wear soft-soled rubber boots or tennis shoes; they are less damaging to the animals than heavy, hard-soled hiking boots. Selection of proper footgear can be another conservation measure.

Many stream and lake access points also suffer from overuse.

1. Students should refrain from throwing rocks into streams and lakes. They may injure a classmate or other users of the site.
2. Even a few students scrambling up a bank can cause erosion to the site, resulting in muddy streams and lakesides.
3. Take litter back to the bus with you.

## *Learning*

A variety of literature and films is available to use in preparing for the trip. This guide lists a variety of educational materials appropriate for both salt- and freshwater sites.

A preparatory visit to any site is *a must*. If it is a saltwater site, pick up a tidetable. Tidetables are available at sporting goods stores, chambers of commerce, tourist information offices, and the local newspapers.

Tides of + 1 or lower are good for tidepooling trips. These tides usually occur during the daylight hours of fall and spring months. The OSU Hatfield Marine Science Center offers a Newport tidetable for the entire year; it must be corrected for other coastal locations.

Schedule a familiarization time when you first reach the site. Plan a discussion to include these points: What kinds of rocks are present? What birds are evident? Is there a lot of driftwood? How steep is the beach? What is the surf condition? Where are any special hazards?

Dividing the class into work crews, each with an assigned task, can mak the trip more worthwhile. What specific program will each crew carry out?

**Observing (saltwater)**

Are there vertical bands of organisms? If so, how many bands are there?

How many different kinds of creatures are found under rocks? Did you return rocks to original postions?

How does a sea anemone feed? (Harvest one mussel for feeding experiments.)

How does a crab eat?

How does a limpet react to juice dripping from a starfish?

Is distribution of organisms different on the wave side of a rock compared to the lee side?

Will there be a camera crew to record the trip and photograph animals found on the beach?

How many different kinds of spines do sea urchins have? How is each used?

**Observing (freshwater)**

What organisms live in this environment?

How many use rocks for homes? Mud? Debris? Eddies?

Do any of the organisms use materials in the water to build their homes?

Do some organisms live only in the current? Under rocks? On top of rocks?

What organisms inhabit the riparian zone nearby?

**Classifying (saltwater)**

How many kinds of algae can you find?

How do snail-shell structures differ in sculpturing, hole size?

How many different species of crabs can you find?

How do various barnacles differ structurally?

How do color patterns and sculpturing differ among limpet shells?

How many different kinds of animals and plants can you find in one tidepool?

**Classifying (freshwater)**

How many different kinds of gravel can you find? Rocks?

Are the sediments sorted out in "beds"?

Can you classify the organisms present into categories according to size? color? body shape? number of legs?

**Measuring (saltwater)**

What is the temperature of a high-level tidepool? A low-level tidepool? The ocean? The air?

What range of shell lengths is found among limpets of the higher rocks?

How long does it take a sea anemone to swallow a bit of food?

How long does it take various starfish to turn over when placed on their top side?

How wide are the bands of organisms on the rocks?

Using a squared wire coat hanger for area reference, what is the density of creatures at different levels of the tidal zone?

If you find barnacles feeding in a tidepool, how many times a minute do they rake their feathery feet through the water?

**Measuring (freshwater)**

What is the velocity of the current?

Is the current the same in all portions of the stream?

How do downed trees and large rocks affect the current?

Does the lake or pond have a current?

What is the depth of the water body?

Is the water the same temperature throughout?

What is the population density of a particular organism? How does it compare with densities for other organisms?

What chemical characteristics does the water have?

## *After the Trip*

Will there be oral presentations, analyzing what each crew did?

Will you share your experiences with other classes in the school?

Will there be a formal evaluation?

Will you integrate the field experience with other experiences?

Will there be a parents' night to show them what you did?

Will you invite representatives of local news media?

Have you or the students written thank-you letters to those who helped you?

Do you have a file on what you will change the next time to go to the intertidal?

# Your "If All Else Fails" Checklist

If nothing in this publication quite suits your fancy, perhaps one of the ideas (arranged by topic below) will help you locate your own local resources. They are all as close as your phone.

### *Coastal Zone Management*

- city, county, and state planning commissions
- port managers
- Sea Grant college programs
- U.S. Coast Guard
- local developers
- industry representatives
- coastal zone management associations
- nonprofit coastal zone conservation organizations
- operators of coastal businesses

### *Curriculum*

- Oregon Department of Education
- NMEA, chapters of NMEA (National Marine Education Association)
- MEMS (Marine Education Materials System)
- Sea Grant college programs and marine Extension programs
- national, state, regional agencies (National Marine Fisheries Service, Bureau of Land Management, U.S. Forest Service, Oregon Department of Fish and Wildlife, Oregon Department of Land Conservation and Development)
- school districts
- teachers
- private consultants
- outdoor school sites and sponsoring groups
- conservation organizations

### *Field Sites*

- aquariums
- parks, national and local historic sites, national recreation areas, monuments
- museums
- shipping and port facilities
- ships
- canneries, fishing boats
- dams, fish hatcheries
- aquaculture facilities
- water treatment plants
- outdoor school sites

### *Equipment*

- science supply houses
- salvage companies
- state surplus facilities
- pet stores
- coastal curio shops and their supply houses
- marine and nautical supply houses
- garage sales

### *Fine Arts*

- local and regional art associations
- museums
- Native American museums and tribes
- local art dealers, art supply stores
- art, music, and literature departments of colleges and universities, or teachers from these departments
- record and sound shops
- libraries

### *Fisheries*

- Sea Grant college programs
- Extension marine agents
- fishers' organizations (fisheries development foundations, etc.), fisher wives organizations
- fishers
- seafood-processing plants and fishing boats
- college fisheries technology programs
- fish hatcheries
- dams and fish ladders
- National Marine Fisheries Service

### *Law*

- U.S. Coast Guard
- law schools
- water resources departments
- EPA (Environmental Protection Agency), DEQ (Department of Environmental Quality)

### *Marine Science*

- NOAA (National Oceanic and Atmospheric Administration)
- Sea Grant college programs
- local teachers and researchers from K-12 schools, community colleges, universities
- National Science Foundation
- oceanography and other departments of universities
- NSTA (National Science Teachers Association), NABT (National Association of Biology Teachers), NMEA (National Marine Education Association), NAME (Northwest Association of Marine Educators)
- marine journals, newsletters, science journals

### *Maritime History*

- museums
- history departments of colleges and universities
- state and local historical societies
- libraries
- Native American tribes

### *Navigation and Shipping*

- port managers, harbormasters
- Navy, U.S. Coast Guard, U.S. Coast Guard Auxiliary
- retired or active captains, pilots, boat owners, fishers
- shipping companies
- longshoremen and their labor organizations
- NOAA (National Oceanic and Atmospheric Administration)
- nautical supply stores

### *Recreation*

- state and national parks, national recreation areas
- U.S. Coast Guard Auxiliary
- boaters and sportsmen
- marina operators, charter boat operators
- port managers, harbormasters

### *Specimens*

- marine science facilities
- fishers and charter boat operators
- friends that live near the ocean
- biological supply houses

### *Water Resources*

- dams, irrigation projects
- managers of water projects
- water treatment plants
- state and regional water resource management offices
- special interest groups (fly-fishing clubs, conservation organizations, etc.)
- government agencies (USFS, BLM, etc.)
- fish and wildlife departments at colleges and universities
- U.S. Weather Service

### *And...*

- thumb through the yellow pages
- stroll along a waterfront
- write the U.S. Superintendent of Documents
- browse in the library
- ask your students

**The Oregon State University Extension Service** provides education and information based on timely research to help Oregonians solve problems and develop skills related to youth, family, community, farm, forest, energy, and marine resources.

**The Extension/Sea Grant program** provides education, training, and technical assistance to people with ocean-related needs and interests. Major efforts are concentrated in the areas of fisheries and wildlife, marine engineering, food science and technology, economics, business, resource management, education, and recreation.

Extension Service, Oregon State University, Corvallis, O.E. Smith, director. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties.

The Extension/Sea Grant program is supported in part by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Oregon State University Extension Service offers educational programs, activities, and materials without regard to race, color, national origin, sex, or disability as required by Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973. Oregon State University Extension Service is an Equal Opportunity Employer.